

REMARKS

Claims 1, 6-13, 16-17, and 46-48 are pending. Applicants respectfully request reconsideration of the above-referenced application in light of the following remarks.

Claims 1, 6-8, 10-13, and 16-17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. patent no. 6,319,553 ("McInerney") in view of U.S. patent no. 5,935,334 ("Fong"). The rejection is respectfully traversed.

The Office Action asserts that McInerney's "loading assembly does 'move' through an inert gas curtain," and cites McInerney's col. 11, lines 54-57 for support (Office Action, pg. 10). McInerney's col. 11, lines 54-57 merely provides that "[p]urge plate 210 continues to flow argon throughout the deposition process, including during the rotation of wafer indexing plate 104 with the wafers." McInerney's col. 11, lines 54-57 does not support the Office Action's statement that a loading assembly moves a substrate through an inert gas curtain.

With respect to all of the pending claims, the Examiner noted "that whether or not McInerney teaches the loading assembly as 'lifting' the wafer is immaterial because McInerney also clearly teaches that the loading assembly as 'rotating', so that the wafers are clearly moved through the inert gas curtain." (Office Action, pg. 10). Applicants respectfully disagrees.

Applicants respectfully submit that McInerney *does* teach a loading assembly that 'lifts' the wafer. The wafer is lifted *above* the reaction chamber. The loading assembly then rotates, and the wafer is moved *over* the next reaction chamber. The loading assembly then *lowers* the wafer into the next reaction chamber. The wafer is *not* moved through an inert gas curtain.

For example, McInerney discloses that the “wafer indexing plate 104 includes a plurality of notches 162, which are used to *lift* a minimum overlap exclusion ring (“MOER” ring) . . . *and the wafer* during indexing.” (Col. 4, lines 31-35) (emphasis added). Further, McInerney discloses that “spindle 109 projects from top surface 108 of chamber base 102 and is used to *lift* wafer indexing plate 104 and *rotate* wafer indexing plate 104 in a clockwise direction when the wafers in chamber 100 are to moved to the *next* processing station.” (Col. 4, lines 22-26) (emphasis added).

The Office Action concludes that because the loading assembly rotates, that the wafers would naturally go through an inert gas curtain. However, there is no support for this teaching or suggestion in McInerney. It is merely the Office Action’s unsupported assertion. McInerney does not teach or suggest moving a substrate *through* an inert gas curtain.

As such, the cited references do not teach an atomic layer doping apparatus comprising, *inter alia*, “a first atomic layer doping region . . . a second atomic layer doping region . . . wherein said first and second atomic layer doping regions are chemically isolated from one another by an inert gas curtain; and a loading assembly for moving said first substrate from said first doping region through said inert gas curtain to said second doping region,” as recited in claim 1.

McInerney does not teach or suggest that a substrate is moved from the first doping region through an inert gas curtain to a second doping region. Fong is relied upon for teaching a first atomic layer region used for deposition and a second atomic layer region used for driving in the dopant atoms, and adds nothing to rectify the deficiencies associated with McInerney.

The cited references do not teach or suggest a loading assembly which moves a substrate from the first doping region through an inert gas curtain to a second doping region. In fact, it is impossible to do so with McInerney's disclosed apparatus. McInerney *lifts* the substrate above one reaction chamber, moves the substrate over another chamber, and then lowers the substrate into the other chamber via wafer indexing plate 104 and spindle 109.

Moreover, there is no motivation to combine the cited references. McInerney relates to a multi-station processing chamber. In other words, at least two different reaction chambers are provided in McInerney's structure. Fong relates to a single reaction chamber 15 (FIG. 1a). For example, Fong discloses that "multiple process steps may be performed in a *single* chamber without having the wafer transferred out of that chamber into other external chambers." (Col. 12, lines 57-60). This is completely different from McInerney.

McInerney discloses that a wafer is moved from one reaction chamber 116 to a second reaction chamber 118 (FIG. 2), and then to a third reaction chamber 114 and a fourth reaction chamber 112. Thus, multiple processes can be carried out in separate reaction chambers. McInerney employs separate reaction chambers since it permits incompatible processes to be performed at the same time. There is no motivation to combine the references since they teach away from each other. One skilled in the art would not combine a multi-chamber apparatus that allows incompatible processes to be performed, with the teachings of an apparatus that employs only one single vacuum chamber 15.

Claims 6-8, 10-13, and 16-17, depend from claim 1 and should be allowable along with claim 1 for at least the reasons provided above, and on their own merits.

Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over McNerney and Fong, and in further view of U.S. patent no. 6,207, 005 ("Henley"). The rejection is respectfully traversed.

Dependent claim 9 should be allowable for at least those reasons set forth above with respect to independent claim 1, and on its own merits. Specifically, McNerney and Fong do not teach or suggest a "loading assembly for moving said first substrate from said first doping region through said inert gas curtain to said second doping region," as recited in claim 1. Moreover, there is no motivation to combine McNerney and Fong since they teach away from each other. Fong discloses performing all processes in one vacuum chamber 15, while McNerney employs different reaction chambers 112, 114, 116, and 118 to perform incompatible processes. Henley is relied upon for teaching three deposition regions and adds nothing to correct the deficiencies found in McNerney and Fong.

Further still, there is no motivation to combine Henley with McNerney and Fong. As indicated above, Fong is directed to a *single* vacuum chamber in which processes are carried out. Fong would not employ three *separate* deposition regions. This defeats the very purpose that Fong relates to. Thus, there is no motivation to combine Henley and Fong since they teach away from each other. As indicated previously, there is no motivation to combine Fong with McNerney since the two references teach away from each other.

Claim 46 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over McNerney in view of Fong and further in view of European patent app. no. 0-060626 ("Gattuso"). The rejection is respectfully traversed.

For similar reasons provided above, McNerney and Fong do not teach or suggest an atomic layer doping apparatus comprising, *inter alia*, "a first atomic layer doping region . . . a second atomic layer doping region . . . being chemically isolated from one another by an inert gas curtain, wherein said inert gas curtain is provided at a higher pressure than an atmosphere containing said first dopant species; and, a loading assembly for moving said first substrate from said first doping region to said second doping region through said inert gas curtain," as recited in claim 46.

McNerney and Fong do not teach or suggest a loading assembly that moves a substrate through an inert gas curtain or that the inert gas curtain is provided at a higher pressure than the first dopant species. McNerney's apparatus employs a wafer indexing plate 104 that *lifts* the substrate from one reaction chamber, rotates the indexing plate 104, and then lowers the substrate into another reaction chamber. It is impossible to move a substrate through an inert gas curtain with McNerney's apparatus without a major redesign of McNerney's apparatus. Gattuso is relied upon for disclosing the use of an inert gas curtain at a higher pressure than the reaction gases, and adds nothing to rectify the deficiencies associated with McNerney and Fong.

The Office Action acknowledges that "McNerney is silent on the pressure at which the inert gas is supplied." (Office Action, pg. 10). Applicants claim that "the inert gas curtain is provided at a higher pressure than an atmosphere containing said first dopant species," as recited in claim 46. There is no suggestion in McNerney to provide an inert gas curtain at a higher pressure than the first dopant species. The exhaust gas port 140 provides a way of evacuating the chambers in McNerney. The exhaust gas port 140 establishes a pressure difference by way of the exhaust gas port vacuum pump 142. Since a pressure gradient is established through annular gaps 126a and 128a by vacuum pump 142, there is no reason or motivation to provide McNerney's inert gas with a higher pressure than the first dopant species.

To establish a *prima facie* case of obviousness, three requirements must be met: (1) some suggestion or motivation, either in the references themselves or in the knowledge of a person of ordinary skill in the art, to modify the reference or combine reference teachings; (2) a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest all the claim limitations. More importantly, the teaching or suggestion to make the claimed combination and the reasonable expectation for success must both be found in the prior art and not based on the Applicants' disclosure. *See, e.g., In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974).

In this case, there is no disclosure in the cited references to combine Gattuso's inert gas curtain having a higher pressure with McNerney's inert gas, when McNerney *already* provides a pressure gradient established by vacuum pump 142. To combine the references is improper hindsight reconstruction. The cited references simply do not teach or suggest that "the inert gas curtain is provided at a higher pressure than an atmosphere containing said first dopant species," as recited in claim 46.

Claim 47 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over McNerney in view of Fong, Gattuso, and to U.S. patent no. 5,382,126 ("Hartig"). The rejection is respectfully traversed.

McNerney, Fong, and Gattuso do not teach or suggest an atomic layer deposition apparatus comprising, *inter alia*, "a first atomic layer doping region . . . a first dopant gas species . . . exhausted through a first gas port; a second atomic layer doping region . . . said first and second doping regions being chemically isolated from one another by an inert gas curtain provided at a higher pressure than an atmosphere containing said first dopant gas species, wherein [a] non-reactive gas species is exhausted through a second gas port; and a loading assembly for moving said first

substrate from said first doping region to said second doping region through said inert gas curtain," as recited in claim 47.

McInerney, Fong, and Gattuso do not teach or suggest a first atomic doping layer region with a first gas port and a second atomic doping layer region with a second gas port. Further, neither references teach alone, or in combination, that the first and second atomic doping regions are separated by an inert gas curtain provided at a higher pressure than said first dopant gas species. Further still, the references do not teach or suggest moving a substrate through an inert gas curtain. Hartig is relied upon the use of separate gas exhausts for each chamber, and adds nothing to rectify the deficiencies of McInerney, Fong, and Gattuso.

The Office Action asserts that Hartig provides motivation to combine for purpose of "aspirating gas from each chamber and further preventing gas transfer between the individual chambers." (Office Action, pg. 8). However, "[t]he mere fact that references can be combined or modified *does not* render the resultant combination obvious unless the prior art also *suggests* the desirability of the combination." M.P.E.P. § 2143.01 (emphasis added). In this case, McInerney discloses only one exhaust port 140. Additional exhaust ports to McInerney's structure would require a major redesign and reconstruction of the apparatus.

It is not proper to combine references where doing so "would require a substantial reconstruction and redesign of the elements shown in [the primary reference, i.e., McInerney] as well as a change in the basic principle under which the [primary reference, i.e., McInerney] construction was designed to operate." *In re Ratti*, 270 F.2d 810, 813, 123 U.S.P.Q. 349, 352 (C.C.P.A. 1959). This is well settled Office policy. See M.P.E.P. § 2143.01, page 2100-127 (Feb. 2003).

McInerney's apparatus would undergo a major redesign and reconstruction of the elements disclosed, if a separate exhaust port is added to each chamber. Each chamber (FIG. 3) would have to be redesigned to accommodate an exhaust port. McInerney's FIG. 3 illustrates that annular gaps 128a and 126a separate the chambers C and D. Again, Applicants submit that the proposed combination is improper hindsight reconstruction.

In fact, the teaching or suggestion to make the claimed combination and the reasonable expectation for success must both be found in the prior art and not based on the Applicants' disclosure. *See, e.g., In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974). In this case, since the primary reference discloses only *one* exhaust port, there is no motivation to use Hartig's exhaust ports since McInerney's single vacuum port 142 aspirates the gas in each chamber C and D through annular gaps 128a and 126a.

Claim 48 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over McInerney in view of Fong, in view of U.S. patent no. 6,527,866 ("Matijasevic"), and in further view of U.S. patent no. 3,618,919 ("Beck"). The rejection is respectfully traversed.

The cited references do not teach or suggest an atomic layer deposition apparatus comprising, *inter alia*, "a first atomic layer doping region comprising a susceptor and a heater assembly . . . a second atomic layer doping region comprising a susceptor and a heater assembly . . . wherein said first and second atomic layer doping regions are isolated from one another by a physical barrier having a closeable opening; and a loading assembly for moving said first substrate from said first doping region to said second doping region through said closeable opening of said physical barrier," as recited in claim 48.

McInerney, Fong, and Matijasevic do not teach or suggest moving a substrate through a physical barrier (Office Action, pg. 9). Matijasevic is relied upon for the use of individual heaters. Beck is relied upon for disclosing the use of a physical barrier for a gaseous atmosphere. However, "[t]he mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." M.P.E.P. § 2143.01. In this situation, there is no teaching or suggestion for employing a physical barrier having a closeable opening in McInerney.

The reactive gases in McInerney "are drawn down into respective wells 126 and 128, *via annular gaps* 126a and 128a, and have little opportunity to migrate toward another pedestal." (Col. 5, lines 37-41) (emphasis added). "The narrow annular gaps permit little or no recirculation of the reactive gases once the gases are drawn into the wells." (Col. 2, lines 9-11). Thus, the presence of a physical barrier having a closeable opening nullifies the importance of annular gaps 126a and 128a. Further, the presence of the annular gaps effectively isolate the adjacent chambers. There is no motivation to modify McInerney and obtain Applicants' claimed physical barrier having a closeable opening, in the atomic layer doping apparatus recited in claim 48.

Moreover, it is not proper to combine references where doing so "would require a substantial reconstruction and redesign of the elements shown in [the primary reference, i.e., McInerney] as well as a change in the basic principle under which the [primary reference, i.e., McInerney] construction was designed to operate." In re Ratti, 270 F.2d 810, 813, 123 U.S.P.Q. 349, 352 (C.C.P.A. 1959). This is well settled Office policy. See M.P.E.P. § 2143.01, page 2100-127 (Feb. 2003).

The "modification" proposed by the Examiner, in the rejection of claim 48, would require a substantial reconstruction and redesign of McInerney's apparatus. In this case, McInerney already discloses that inert gas is provided to separate chamber C from chamber D (FIG. 3) through annular gaps. McInerney's structure would have to be redesigned to accommodate a physical barrier having a closeable opening.

Moreover, since McInerney discloses *lifting* the substrate from one reaction chamber by indexing plate 104, rotating the indexing plate by spindle 109, thus moving the substrate to another reaction chamber, and then lowering it, there would be no motivation to even have a physical barrier with a closeable opening. If anything, McInerney would simply use a physical barrier and not one with a closeable opening since the substrate in McInerney is lifted, rotated, and lowered from one chamber to another reaction chamber. By contrast, Applicants claim moving the substrate from one doping region to another through the closeable opening in the physical barrier.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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Respectfully submitted,

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